

## CLAIMS

1. A method for forming a plurality of recombined homologous double-stranded polynucleotides from at least two homologous double-stranded template polynucleotides, said method comprising the steps of:
  - 5 a) providing a solution comprising at least two non-methylated homologous double-stranded template polynucleotides and one or more mismatch repair protein(s);
  - b) denaturing the template polynucleotides into single-stranded polynucleotides;
  - c) annealing the different single-stranded polynucleotides, wherein heteroduplexes are formed;
  - 10 d) allowing the mismatch repair protein(s) to repair nucleotide mismatches in the heteroduplexes, wherein recombined new duplexes are formed; and
  - e) optionally, repeating steps b) through d) for one or more cycles; wherein the new duplexes of step d) serve as new template polynucleotides in step b) in each subsequent cycle.
- 15 2. The method of claim 1, wherein the at least two homologous double-stranded template polynucleotides are obtained by PCR amplification.
- 20 3. The method of claims 1 or 2, wherein the at least two homologous double-stranded template polynucleotides encode homologous polypeptides.
- 25 4. The method of any of claims 1 - 3, wherein the at least two homologous double-stranded template polynucleotides encode homologous enzymes, preferably amylases, proteases, cellulases, lipases, xylanases, or phospholipases.
5. The method of any of claims 1 – 4, wherein the solution comprises a population of cells or a lysate of a population of cells.
6. The method of claim 5, wherein the population of cells or the lysate of a population of  
30 cells comprises the at least two homologous double-stranded template polynucleotides.
7. The method of claims 5 or 6, wherein the population of cells or the lysate of a population of cells comprises the mismatch repair protein(s).

8. The method of any of claims 5 – 7, wherein the population of cells, or the population of cells giving rise to the lysate, do not methylate newly synthesized polynucleotides.

9. The method of any of claims 1 – 8, wherein the mismatch repair protein(s) is (are)  
5 thermostable.

10. The method of any of claims 1 – 9, wherein the thermostable mismatch repair protein(s) comprises a MutS homologue, preferably MutS YT1 of *Thermus aquaticus*.

10 11. The method of any of claims 1 – 9, wherein the thermostable mismatch repair protein(s) comprises a MutL homologue, a MSH2 homologue, a MSH6 homologue, a MutM homologue, a MutY homologue, a MutT homologue, a MutH homologue, a HexA homologue, a HexB homologue, or a GTBP/p160 homolog.

15 12. The method of any of claims 1 – 11, wherein the denaturing is achieved by increasing the temperature of the solution, preferably to at least 90°C.

13. The method of claim 12, wherein the annealing is achieved by lowering the temperature of the solution, preferably at least to a temperature at which the mismatch repair  
20 protein(s) functions, more preferably at least to between 55°C and 75°C.

14. The method of any of claims 1 – 13, wherein steps b) through d) are repeated for between 1 and 10 cycles; wherein the new duplexes of step d) serve as new template polynucleotides in step b) in each subsequent cycle.

25 15. The method of any of claims 1 – 13, wherein steps b) through d) are repeated for at least 10 cycles; wherein the new duplexes of step d) serve as new template polynucleotides in step b) in each subsequent cycle.

30 16. The method of any of claims 1 – 15, wherein additional steps are performed, said additional steps comprising:

- f) generating a gene library by cloning the plurality of recombined polynucleotides;
- g) expressing and screening the gene library for an activity or property of interest; and

h) isolating or identifying the recombined polynucleotide which gives rise to the activity or property of interest.

17. A plurality of recombined polynucleotides generated by a method as defined in any of  
5 the claims 1 – 16.

18. A recombined polynucleotide generated by a method as defined in any of the claims 1 – 16.

10 19. Use of a plurality of recombined polynucleotides generated by a method as defined in any of the claims 1 – 16, in a screening assay for an activity or property of interest.

20. Use of a recombined polynucleotide generated by a method as defined in any of the claims 1 – 16, for expression or production of a polypeptide of interest.